

Alaska FACE

FATALITY ASSESSMENT & CONTROL EVALUATION

Mechanic struck-by backhoe while assisting with excavator disassembly

FACE 01-AK-008

Release Date: May 17, 2002

SUMMARY

A heavy equipment mechanic was killed when he was struck by a backhoe while assisting a co-worker, also a mechanic, with the disassembly of an excavator. They were attempting to remove a linkage pin holding the boom and stick sections together. After several attempts to manually remove the pin, they solicited the assistance of a worker from another company who was operating a backhoe at the construction site. The worker (operator) was not a qualified equipment operator and had limited experience operating a backhoe. The operator drove the backhoe over to the excavator. In order to remove the pin, the workers used the edge of the backhoe's bucket to apply pressure to the pin. A 2-½ inch diameter pipe was used as an extension to the pin. The victim climbed up a ladder to hold the pipe in position until adequate pressure from the backhoe held it in place. The co-worker entered the cab of excavator to adjust the boom's position, if necessary, to facilitate the pin's removal. The backhoe operator could see the victim's torso and right hand below the bucket; his left hand and the pipe were visible above the bucket.

The victim, using his right hand, gave hand signals to the operator to move forward and place the edge of the bucket on the pipe. However, the victim's position placed his head in front of the bucket. Before the victim could move down the ladder, to clear his head from the bite zone, the

backhoe lurched forward. The victim's head was struck by the bucket; the force knocked him off the ladder and against the boom of the excavator.

The co-worker came to the aid of the victim while the backhoe operator drove the backhoe to another area to call for help. The victim was transported to a nearby medical center by emergency medical service where he died from his injuries.

Based on the findings of the investigation, to prevent similar occurrences, employers should:

- **Ensure workers are capable of recognizing and avoiding hazardous situations and should develop and implement a safety program facilitating safe worksite practices;**
- **Ensure that mechanics and operators use manufacturer-recommended practices for disassembly of heavy equipment;**
- **Ensure that all personnel involved in heavy equipment assembly and disassembly are knowledgeable with the process and equipment to be used.**

INTRODUCTION

At 12:30 PM on May 6, 2001, a 41-year-old male heavy equipment mechanic (the victim) was struck-by by backhoe while assisting with the disassembly of an excavator. On the May 8, 2001, Alaska Department of Labor and Workforce Development (AKDOWD) notified the Alaska Division of Public Health, Section of Epidemiology. An investigation involving an Injury Prevention Specialist for the Alaska Department of Health and Social Services, Section of Epidemiology ensued on May 9, 2001. The incident was reviewed with company representatives and AKDOLWD officials. AKDOLWD, police, and Medical Examiner reports were requested.

The company in this incident was a construction contractor and rental/repair service of heavy equipment (such as excavators) since 1971. The company had 53 employees, of which 6 were mechanics. At the time of the incident, the company had three shop locations and had been in the

incident area for 2 years. The victim was a journeyman mechanic with approximately 25 years work experience and had completed training as a heavy equipment mechanic. The company had recently employed the victim; he had worked primarily as a shop mechanic for the past 30 days. Prior to his employment with the company, he had worked as a field mechanic.

The company had written safety policies and practices but no formal safety training program. Safety training was on-the-job, however new employees were given informal training that included an orientation of the shop and review of company policies and practices including, but not limited to, alcohol abuse, driving, and tool use and maintenance. Employees met weekly for a general safety meeting. Topic included personal protective equipment, complacency to safety, and open roundtables to discuss work orders, practices, and safety issues. Safety meetings were also conducted on an "as needed" basis.

INVESTIGATION

The incident occurred at a large construction site. The site was a open area that appeared level and dry. The ground consisted of soft, partially compacted soil and crushed rock. Other than the equipment involved, there were no visual obstructions. Weather was not considered a factor in this incident.

The excavator involved in this incident was a Caterpillar 375 L. The approximate weight of the unit was 169,000 pounds. Due to weight limitation for ground freight by the Alaska Department of Transportation, excavator needed to be disassembled prior to transport to another location. The manufacturer recommended to segment the excavator into seven major portions for transportation: the base machine, counter weight, operator's cab, boom cylinders, boom, stick, and bucket (Figure 1). The boom, stick, and bucket sections (Figure 2) were attached by linkage pins that were inserted into two openings at the end of each section. (Thus, the pin would be inserted through a total of four bushings.)

On the day of the incident, the victim's co-worker had been dispatched to the incident site to disassemble and transport the excavator to the company's yard. The co-worker was a journeyman mechanic and a qualified equipment operator. He had assembled and disassembled this type and model of excavator several times. After arriving to the site, he found that the excavator had been relocated. He had called his supervisor to inform him that the excavator had been moved. Due to the time to disassemble the unit, the leasing company had relocated it to an area with lower traffic patterns. His supervisor went to inspect the site and gave permission to continue the disassembly.

After completing previously assigned tasks, the victim was asked if he could assist his co-worker at the incident site. Upon his arrival to the site, he found that his co-worker had disconnected the hydraulic hoses and lines and had secured and suspended the stick section using the tines of a frontend loader. The bucket, still attached to the stick, was resting on the ground. They spent approximately 15 minutes trying to remove the linkage pin connecting the stick to the boom. The linkage pin for these joined sections were approximately 5 inches in diameter, 33 inches long, and weighs 250 pounds. . Normal procedure is to use a pin pusher to push the linkage pin out of the linkage eyes. The pin pusher is a solid bore shaft used as an extension to the linkage pin; it is short in length and slightly smaller in diameter than the linkage pin. While the stick of the excavator is secured and supported, a sledgehammer is used to hit the pin pusher and dislodge the linkage pin. The pin is not removed completely until it can be supported. At times, the linkage pin cannot be dislodged in this manner and a backhoe (or similar equipment) to mechanically push the pins through the linkage eyes and bushings (Figure 2). Another alternate method to dislodge the pin, as recommended by the manufacturer, is to use a pin puller, which threads into a hole at the end of the linkage pin. However, the puller needs to be supported by a lifting strap and a hoist.

In this incident, the linkage pin could not be removed, and the co-worker requested to use a backhoe from another contractor at the construction site. In addition, the co-worker requested an

operator from the other company to assist them. After a short period of time, a backhoe was brought over to the excavator. However, the operator was not a qualified equipment operator and had limited experience operating a backhoe. He was using the equipment for tasks as assigned by his supervisor at the site.

After a brief discussion of their task, the co-worker help the backhoe operator align the edge of the backhoe's front bucket with the pin pusher to apply direct pressure. While standing on a 7-foot ladder, the co-worker held the pin pusher in position. Once held in position by the backhoe, he stepped down to remove himself from the bite area and signaled the backhoe operator to continue forward. The linkage pin was not completely dislodged. On the next attempt, if he could not see any movement of the pin when pressure (from the backhoe) was applied, the co-worker would move the boom (of the excavator) up slightly to shift the alignment of the linkage eyes. Since the pin pusher was too short, a 2 1/2-inch diameter pipe was used as an extension.

With his co-worker in the excavator's cab, the victim stood on the ladder, holding the pipe in his left hand. The front edge of the bucket was placed against the end of the pipe; the pipe contacted the bucket approximately 3 feet from the bucket's left side. The victim's position on the ladder placed him approximately 1 foot from the left side of the bucket, inside the bite area. The backhoe operator had the front bucket tipped slightly down so he could see the end of the pipe. He could see the victim's torso and right hand, which he was using to give hand signals, below the bucket. However he could not see the victim's head.

The victim directed the backhoe to move forward to contact the pipe. The pipe appeared slightly bent, which may have caused problems applying directional pressure. After contacting the pipe, the backhoe lurched forward. The bucket struck the victim's head and knocked him into the boom of the excavator. The victim fell to the ground. Both workers came to aid the victim. The backhoe operator left in the backhoe to get help or call 911. The co-worker stayed at the incident with the victim. Using a cell phone, he called their supervisor to report the incident and request

medical assistance. The supervisor immediately called 911. Emergency service personnel were dispatched. The victim was transported to a nearby medical center where he was declared dead soon after arrival.

CAUSE OF DEATH

The medical examiner's report listed the cause of death as blunt trauma to the head.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employer should ensure workers are capable of recognizing and avoiding hazardous situations and should develop and implement a safety program facilitating safe worksite practices.

Discussion: In this incident, workers placed themselves between a stationary object (the excavator) and moving equipment (the backhoe). Workers should always avoid any place where a body part can be caught or struck by machinery. The National Safety Council has noted that accidents caused by unsafe practices outnumber accidents from unsafe condition of equipment. It is well warranted for employers to thoroughly check and train operators and mechanics. Training should include, but not be limited to, —

- 1) Manufacturer-recommended procedures for maintenance, repair, and operations
- 2) Proper use of equipment to safeguard against personal injury
- 3) Common equipment problems and solutions
- 4) Center of gravity and lift capacity of other equipment used to support and suspend parts
- 5) Safety procedures for picking up and moving sections of equipment for transport

Training should be documented in the employee record and include training dates, completion verification, and course content (checklist). Random observations would be helpful to ensure continued use of safe practices.

Recommendation #2: Employer should ensure that mechanics and operators use manufacturer-recommended practices for disassembly of heavy equipment.

Discussion: In this incident the manual methods used to push out the linkage pin were acceptable as normal industry practices. However, the victim did not follow prescribed work tools that required the use pin pusher, which is larger in diameter and capable of withstanding heavy-duty use to extract a linkage pin. While the pipe used in this incident provided sufficient length to extract the linkage pin, it was less durable and was bendable.

Alternately, employers should consider the use of portable working platforms designed specifically for stick removal, such as a Williams bracket. These platforms provide a two-man work area while supporting the stick section during its removal from the boom section and preventing damage to hoses and lines. In addition, the platform supports the use of manufacturer pin removal tools, such as hydraulic pin press or pin pusher. Prior to placing a device into service, employers must insure that it meets all OSHA requirements.

Employers should consider conducting random work site safety inspections and supervisor observations to evaluate worker compliance with established safety standards and practices and their understanding of a proactive safety program. In addition to specific safe practices, steps should be outlined and discussed with employees for noncompliance with an established safety program. While employees have the right to question the safety of any task, they are responsible for following the practices outlined by their employers safety program.

Recommendation #3: Employers should ensure that all personnel involved in heavy equipment assembly and disassembly are knowledgeable with the process and equipment to be used.

Discussion: An operator is responsible for the safety of other workers who must be near the equipment. In the case, a non-qualified equipment operator with limited knowledge and equipment experience was asked to assist the mechanics. Any new worker should be referred to

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the supervisor who should evaluate the worker's skill level and knowledge. In addition, the supervisor should evaluate the task to determine if a worker's skill level and knowledge is adequate to perform the task competently and without risk to his co-workers.

REFERENCES

National Safety Council. Accident Prevention Manual for Business & Industry: Administration & Programs. 10th ed. Chicago IL; 1992.

Figure 1. Excavator configuration for segment separation

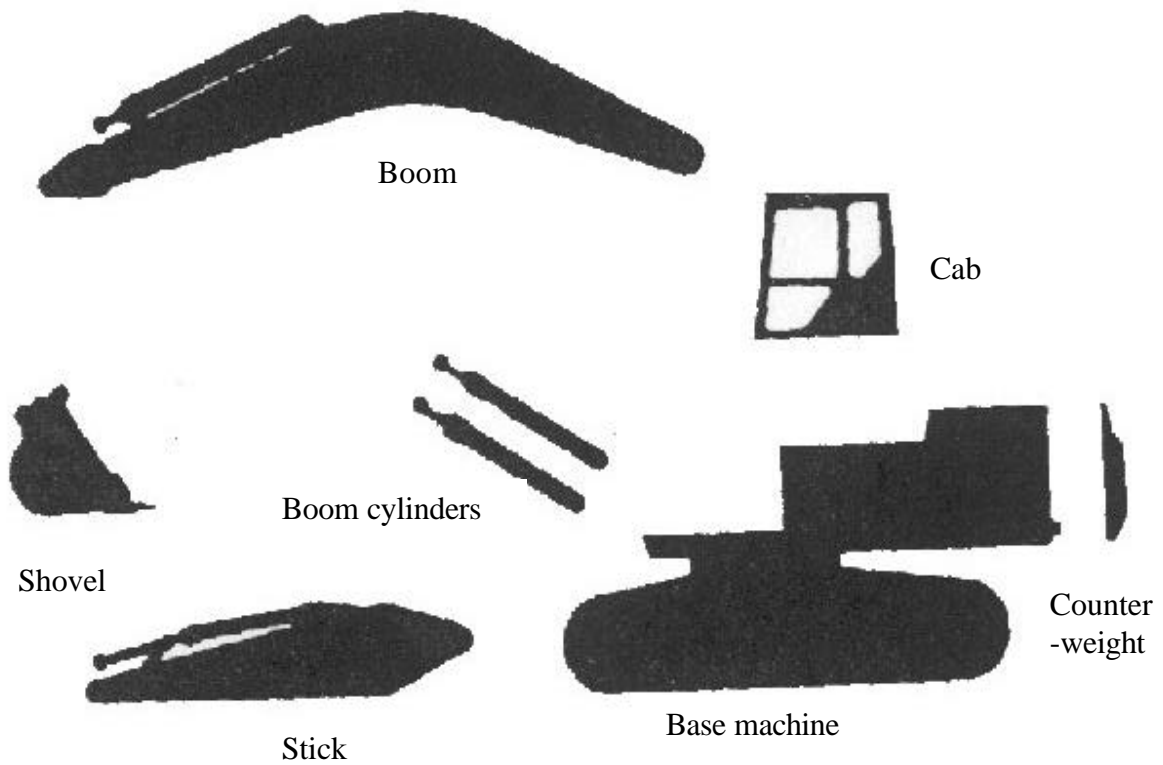
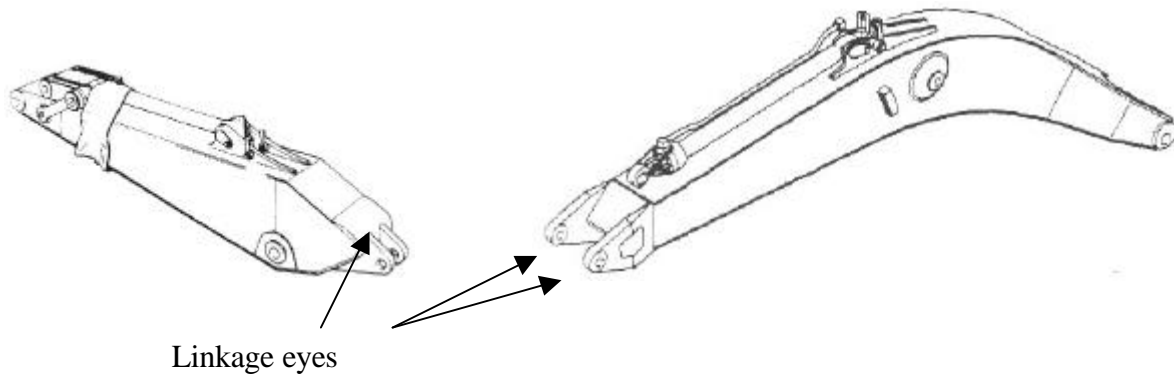


Figure 2. Boom and stick segments of excavator



John Middaugh, MD
State Epidemiologist
Division of Public Health
Alaska Dept. of Health & Social Services

Deborah Choromanski Hull-Jilly, MPH
Occupational Injury Prevention Program Manager
Section of Epidemiology
Alaska Dept. of Health & Social Services

Fatality Assessment and Control Evaluation (FACE) Project

The Alaska Division of Public Health, Section of Epidemiology performs Fatality Assessment and Control Evaluation (FACE) investigations through a cooperative agreement with the National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR). The goal of these evaluations is to prevent fatal work injuries in the future by studying the working environment, the worker, the task the worker was performing, the tools the worker was using, the energy exchange resulting in fatal injury, and the role of management in controlling how these factors interact.

Additional information regarding this report is available from:

Alaska Occupational Injury Prevention Program
Section of Epidemiology
PO Box 240249
Anchorage, AK 99524-0249
Phone (907) 269-8000
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